



RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)

R.V. Vidyaniketan Post, Mysore Road

Bengaluru – 560 059



Scheme and Syllabus of V & VI Semesters

2018 SCHEME

MASTER OF COMPUTER APPLICATIONS

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

1. To deliver outcome based Quality education, emphasizing on experiential learning with the state of the art infrastructure.
2. To create a conducive environment for interdisciplinary research and innovation.
3. To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
4. To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
5. To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work and Innovation

RV College of Engineering®

(Autonomous Institution affiliated to VTU, Belagavi)



Department of Master of Computer Applications

Scheme and Syllabus of V & VI Semesters

2018 SCHEME

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

DEPARTMENT VISION

Pioneering in ICT Enabled Quality Education and Research with a focus on Sustainable and Inclusive Applications

DEPARTMENT MISSION

1. To adapt novel methodologies for quality education through experiential learning
2. To empower students with continuous, holistic education, emphasizing on discipline, ethics and social commitment
3. To become a vibrant knowledge center for research and software development.
4. To continuously build capacity steering towards industry- institute collaborative research and entrepreneurial competencies
5. To utilize and develop free and open source software tools for sustainable and inclusive growth

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO1** Practice software engineering principles and standards to develop software to meet customer requirements across verticals
- PEO2** Contribute to build sustainable and inclusive applications using mathematical, simulation and meta heuristic models
- PEO3** Demonstrate entrepreneurial qualities through individual competence and team work
- PEO4** Achieve successful professional career with integrity and societal commitments leading to lifelong learning

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	Solve real world computing system problems of various industries by understanding and applying the principles of mathematics, computing techniques and business concepts
PSO2	Design, test, develop and maintain desktop, web, mobile and cross platform software applications using modern tools and technologies

ABBREVIATIONS

Sl. No.	Abbreviation	Acronym
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	CE	Professional Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	CV	Civil Engineering
9.	ME	Mechanical Engineering
10.	EE	Electrical & Electronics Engineering
11.	EC	Electronics & Communication Engineering
12.	IM	Industrial Engineering & Management
13.	EI	Electronics & Instrumentation Engineering
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	ET	Electronics & Telecommunication Engineering
17.	IS	Information Science & Engineering
18.	BT	Biotechnology
19.	AS	Aerospace Engineering
20.	PY	Physics
21.	CY	Chemistry
22.	MA	Mathematics
23.	MCA	Master of Computer Applications
24.	MST	Structural Engineering
25.	MHT	Highway Technology
26.	MPD	Product Design & Manufacturing
27.	MCM	Computer Integrated & Manufacturing
28.	MMD	Machine Design
29.	MPE	Power Electronics
30.	MVE	VLSI Design & Embedded Systems
31.	MCS	Communication Systems
32.	MBS	Bio Medical Processing Signal & Instrumentation
33.	MCH	Chemical Engineering
34.	MCE	Computer Science & Engineering
35.	MCN	Computer Network Engineering
36.	MDC	Digital Communication
37.	MRM	Radio Frequency and Microwave Engineering
38.	MSE	Software Engineering
39.	MIT	Information Technology
40.	MBT	Biotechnology
41.	MBI	Bioinformatics

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MASTER OF COMPUTER APPLICATIONS

FIFTH SEMESTER CREDIT SCHEME							
Sl. No.	Course Code	Course Title	BoS	Credit Allocation			Total Credits
				L	T	P	
1	18MCA51	Software Project Management	MCA	3	0	0	3
2	18MCA52	Big Data Analytics	MCA	3	1	1	5
3	18MCA53X	Elective – VI	MCA	3	0	0	3
4	18MCA54X	Elective – VII (with Practice)	MCA	3	1	1	5
5	18MCA55	Seminar-1	MCA	0	0	2	2
6	18MCA56	Minor Project – II	MCA	0	0	4	4
Total Number of Credits				12	2	8	22
Total number of Hours/Week + Counselling				12	4	16	32

V Semester			
Elective – VI			
Sl. No.	Course Code	Course Title	Credits
1.	18MCA531	Wireless Mobile Networks	3
2.	18MCA532	Software Performance Engineering	3
3.	18MCA533	Principles of UI/UX Design	3

V Semester			
Elective VII (With Practice)			
Sl. No.	Course Code	Course Title	Credits
1.	18MCA541	Cloud Computing	5
2.	18MCA542	Internet of Things	5
3.	18MCA543	Virtual Reality	5

SIXTH SEMESTER CREDIT SCHEME							
Sl. No	Course Code	Course Title	BOS	Credit Allocation			Total Credits
				L	T	P	
1.	18MCA61	Major Project	MCA	-	-	20	20
2.	18MCA62	Seminar-2	MCA	-	-	2	2
Total Number of Credits						22	22
Total number of Hours/Week							

SEMESTER: V			
SOFTWARE PROJECT MANAGEMENT			
(Theory)			
Course Code	: 18MCA51	CIE Marks	: 100
Credits: L:T:P	: 3:0:0	SEE Marks	: 100
Total Hours	: 39L	SEE Duration	: 03 Hrs
Unit – I			08 Hrs
Introduction to Software Project Management- Introduction, Why is Software Project Management important?, What is a Project?, Software Projects versus other types of Project, Contract Management and Technical Project Management, Activities covered by software project management, Plans, methods & Methodologies, Stakeholders, Setting Objectives, The Business Case, Project Success and Failure, What is Management?			
Unit – II			08Hrs
Project Evaluation- Introduction, A Business Case, Evaluation of individual projects, Cost-Benefit Evaluation Techniques, Risk Evaluation			
Project Stakeholders and Governance- Project stakeholders, project governance, project success			
Unit – III			08 Hrs
An Overview of Project Planning- Introduction to Step-wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyze Project Characteristics, Step 4: Identify Project Products and Activities, Step 5: Estimate Efforts for each activity, Step 6: Identify Activity Risks, Step 7: Allocate Resources, Step 8: Review / Publicize Plan, Step 9 & 10: Execute Plan / Lower Levels of Planning			
Unit – IV			08 Hrs
Activity Planning- Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the time dimension, Forward Pass, The Backward Pass, Identifying the critical path, Activity Float, Shortening the Project duration, Identifying critical activities, Activity-on-Arrow Networks			
Risk Management – Risk, Categories of Risk, Risk Identification, Risk Assessment, Risk Planning and Risk Management			
Monitoring and Control- Introduction, Creating the Framework, Collecting the Data, Review, Project Termination Review, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project back to Target, Change Control			
Unit – V			07 Hrs
Managing People in Software Environments- Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting the right person for the job, Motivation, Stress, Health & Safety, Some Ethical and Professional Concerns			
Software Quality- ISO 9126, Product and project metrics, quality plans			

Course Outcomes: After going through this course the students will be able to	
CO1:	Explain the practices and methods for successful software project management
CO2:	Identify techniques for requirement, policies and decision making for effective resource Management
CO3:	Apply the evaluation techniques for estimating cost ,benefit, schedule and risk
CO4:	Devise a framework for planning software project management activities, risk, staffing, monitoring and control

Reference Books	
1.	“Software Project Management”, Bob Hughes, Mike Cotterell, Rajib Mall, Special Indian Edition, 5 th Edition, 2011, Tata McGraw-Hill Education, Delhi, ISBN-13: 978-0-07-107274-8, ISBN-10: 0-07-107274-8
2.	“A Guide to the Project Management Body of Knowledge (PMBOK Guide)”, PMI, 6 th Edition, 2017, PMI, ISBN NO 9781628251845.
3	”Applied Software Project Management”, Andrew Stellman, Jennifer Greene, July 2008, <u>O'Reilly Media</u> , ISBN 978-0596009489.
4	“Project Management, A System Approach to Planning Scheduling & Controlling”, Harold Kerzer, 11 th Edition, 2013, John Wiley & Sons Inc., ISBN 978-1-118-02227-6.

Continuous Internal Evaluation (CIE): Theory (100 Marks)
CIE is executed by way of Quizzes(Q), Test(T) and Experiential Learning(EL). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two Experiential Learnings are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project Total CIE is 20(Q)+50(T)+30(EL)=100 Marks
Semester End Examination (SEE): Theory (100 Marks) The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	M	-	H	M	M	M	-	-
CO2	M	M	H	H	L	M	H	M	-	M	-	-
CO3	M	H	M	H	-	L	H	-	-	M	-	-
CO4	H	L	M	M	M	M	H	M	-	H	-	-
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
CO/PSO	PSO1						PSO2					
CO1	M						M					
CO2	M						M					
CO3	H						H					
CO4	H						H					
High-3: Medium-2: Low-1												

SEMESTER: V					
BIG DATA ANALYTICS (Theory & Practice)					
Course Code	:	18MCA52	CIE Marks	:	100+50
Credits: L:T:P	:	3:1:1	SEE Marks	:	100+50
Total Hours	:	39L+26T+26P	SEE Duration	:	3 Hrs(T) 3Hrs(P)
Unit – I				08 Hrs	
Introduction to Data Analytics & Hadoop Eco System					
Hadoop Fundamentals					
Data, Data Analysis and storage, Comparison with other systems – Relational Database Management Systems					
The Hadoop Distributed File system					
The Design of HDFS, HDFS Concepts – Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS High Availability, The command-Line Interface, Hadoop File system – Interfaces					
Data Flow – Anatomy of a File Read, Anatomy of a File Write					
Unit – II				08 Hrs	
Map Reduce - A Weather Dataset – Data format, Analyzing the data with Unix Tools, Analyzing the Data with Hadoop, Scaling Out					
Working of Map Reduce - Anatomy of a Map Reduce Job Run, Failures, Shuffle and Sort, Task Execution					
Map Reduce Formats - Input Formats, Output Formats					
Unit – III				08 Hrs	
Pig Introduction – Execution types, Running Pig programs, Grunt, Pig Latin Editors, Comparison with databases					
Pig Latin – Structure, Statements, Expressions, Types, Schemas, Functions, Macros					
Data Processing Operators – Loading and storing of data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and splitting Data					
Pig in Practice– Parallelism, Anonymous Relations, Parameter Substitution					
Unit – IV				08 Hrs	
Hive Introduction – The Hive shell, Hive services, the Meta store					
Comparison with Traditional Databases – Schema on Read Versus Schema on Write, Updates, Transactions and Indexes					
Hive QL – Data Types, operators and functions					
Tables – Managed Tables and External Tables, Partitions and Buckets, Storage Formats, Importing Data, Altering Tables, Dropping Tables					
Querying Data – Sorting and Aggregating, Joins, Sub queries, Views					
Unit – V				07 Hrs	
Data Visualization – I – Introduction, Techniques used for visual Data Representation, Types of Data Visualization, Applications of Data Visualization, Visualizing Big Data, Tools used in Data Visualization, Tableau Products					
Data Visualization with Tableau – Introduction to Tableau software, Tableau Desktop Workspace, Data Analytics in Tableau Public, Using visual controls in Tableau Public					

Unit VI - Lab Component

Introduction to Hadoop Ecosystems

Review the commands available for the Hadoop Distributed File System:

- a) Copy file foo.txt from local disk to the user's directory in HDFS
- b) Get a directory listing of the user's home directory in HDFS
- c) Get a directory listing of the HDFS root directory
- d) Display the contents of the HDFS file user/fred/bar.txt
- e) Move that file to the local disk, named as baz.txt
- f) Create a directory called input under the user's home directory
- g) Delete the directory input old and all its contents
- h) Verify the copy by listing the directory contents in HDFS

1 --- Map Reduce Program on Counting

- a) Write a Java Program using Mapper and Reducer function to find the number of records in the give dataset
- b) Submit the job to cluster
- c) Track the job information

2 --- Map Reduce Program using Temperature Dataset

- a) Write a Java program for finding Maximum recorded temperature by the year from Weather Dataset
- b) Submit the job to cluster
- c) Find the status of the Job and terminate it

3 --- Programs on Pig Script Using movie lens data

- a) List all the movies and the number of ratings
- b) List all the users who have rated the same movie and find the number of ratings
- c) List all the Users who have rated the movies (Users who have rated at least one movie)
- d) Find the count of the Movie which has the ratings more than 3
- e) Find the max, min, average ratings for all the movie

4--- Program on Advanced Concepts in Pig

- f) Group by Year and dump the result in a bag
- g) Write a pig script to find the maximum temperature
- h) Write a pig Script to find the average temperature of a state for 3 years and store the result in HDFS

5-- Demonstrate Anonymous Relation and Parameter Substitution to find Maximum Temperature in a given Dataset using Pig script

6 -- Extract facts using Hive on movie lens data

- a) Write a query to select only those records which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows.
- b) Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.
- c) Create the staging table and Load the results of the previous two queries into a staging table

7 – Extract facts using Zipline

- a) Write a query to find the total number of cities where NO2 is greater than 20.
- b) Write a query to select only those cities which correspond to type of location-Industrial Area where temperature is greater than 25 and less than 40
- c) Write a query to select city and Monitoring Location and type of location where NO2 greater than 25
- d) Write a query to display the city names and Location of Monitory Station where SO2 and NO2 values are greater than 11 and 22

8-- Consider the superstore dataset

- a) Write a query to find the Top 10 sales for the current year, previous year, previous quarter, and previous month.
- b) Write a query to find the sales for consumer & corporate segment for order between 2015 – 2019
- c) Write a query to find the maximum discount for all the products in the region south and central for the year 2015 & 2017
- d) Write a query to find the bottom 10 profit by Country, State & City
- e) Demonstrate the visualization for profit percentage by region

9 – Creation of Story Board

Demonstrate and Create a story board of your choice using any BI Tool

Course Outcomes: After going through this course the students will be able to

CO1:	Understand the fundamentals of data analytics techniques and platforms
CO2:	Apply data analytics ecosystem and visualization techniques to solve various problems
CO3:	Analyse the use of data analytics and visualization for various problems
CO4:	Evaluate the solutions of data analytics ecosystems

Reference Books:

1	“Hadoop – The Definitive Guide; Storage and Analysis at Internet scale”, Tom White, 4 th Edition, 2015, O’Reilly, Shroff Publishers & Distributers Pvt. Ltd., ISBN – 978-93-5213-067-2
2	DT Editorial Services “Big Data – Black Book” Dreamtech Press, Edition – 2015, ISBN - 978-93-511-9-757-7
3	“Hadoop for Dummies”, Dirk deRoos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, Rafael Coss, 2014, John Wiley & Sons, Inc., ISBN: 978-1-118-60755-8 (pbk); ISBN 978-1-118-65220-6 (ebk); ISBN 978-1-118-70503-2 (ebk)
4	”Big Data Principles and best practices of scalable real-time data systems”, Nathan Marz and James Warren, April 2015, ISBN 9781617290343

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Experiential Learning(EL). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two Experiential Learnings are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(EL)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)
 The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.
 Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	M	L	-	L	L	-	-	-	-
CO2	H	M	L	M	M	-	-	-	-	-	-	-
CO3	H	H	L	M	M	-	-	-	-	-	-	-
CO4	H	M	L	M	L	-	-	-	-	-	-	-
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
CO/PSO	PSO1						PSO2					
CO1	M						M					
CO2	H						M					
CO3	M						M					
CO4	H						M					
High-3: Medium-2: Low-1												

SEMESTER: V			
WIRELESS MOBILE NETWORKS			
(Theory)			
Course Code	:	18MCA531	CIE Marks : 100
Credits: L:T:P	:	3:0:0	SEE Marks : 100
Total Hours	:	39L	SEE Duration : 3 Hrs
Unit – I			08 Hrs
Wireless Telecommunication Systems & Networks: History and Evolution of Wireless Radio Systems, The Development of Modern Telecommunications Infrastructure, Overview of Existing Network Infrastructure, Review of the Seven Layer OSI Model, Wireless Network Applications			
Unit – II			08 Hrs
Basics of Wireless Networks: Wireless Networks, Wireless Switching Technology, Wireless Network Reference Model. Cellular Mobile Wireless Networks: System Design Fundamentals and Propagation Path Loss Models- Description of Cellular Systems, Propagation Models for Wireless Networks - Free-space Propagation Model and Two-Ray Ground Reflection Model.			
Unit – III			08 Hrs
Second-Generation Mobile Networks-GSM: Architecture and Protocols – GSM Network Architecture, GSM Multiple Access Scheme, GSM Protocols and Signalling, Authentication and Security. 3G-The Universal Mobile Telecommunication System (UMTS): UMTS Network Architecture-Release, UMTS Interfaces, UMTS Networks Evolution, UMTS Network Protocol Architecture			
Unit – IV			08 Hrs
Fundamentals of Wireless Local Area Networks: IEEE 802.11, WLAN Transmission Technology, WLAN System Architecture, CSMA/CD, CSMA/CA Cellular and WLAN Integration: Heterogeneous Network Architecture, Step Towards 4G Networks: IEEE 804.11 Overview, Complementary Features of Cellular and WLAN, Suitable Point of Integration, Integration Architecture			
Unit – V			07 Hrs
Overview of WiMAX Technologies - Broadband Wireless Communications: Evolution of Broadband Wireless, Spectrum Allocation, IEEE 802.16 Standard Architecture, Overview of WiMAX PHY, IEEE 802.16 MAC Layer Overview, IEEE 802.16 Scheduling Services, Network Architecture, 804.16e Handover Procedures			

Course Outcomes: After going through this course the students will be able to	
CO1:	Understand the basic concepts and standards related to wireless mobile networks.
CO2:	Explore various concepts and principles used in wireless network
CO3:	Build knowledge upon architecture and protocols of wireless mobile networks
CO4:	Analyse the design issues in wireless and mobile networks

Reference Books	
1	“Introduction to Wireless Telecommunication Systems & Networks”, Gary J Mullet. 2010 Cengage Learning (India) Pvt Ltd, ISBN – 13: 978-81-315-0559-5
2	“Wireless Communications and Networks: 3G and Beyond, 2e.”, ItiSahaMisra, 2013, McGraw Hill Education (India) Pvt Ltd, ISBN – 13:978-1-25-906273-5.
3	“Wireless and Mobile Networks: Concepts and Protocol”, Dr.SunilKumar S. Manvi, MahabaleshwarS. kakkasageri, Reprint 2012, Wiley India, ISBN: 978-81-265-2069-5.
4	“Fundamentals of 5G mobile networks”, Rodriguez, Jonathan, ed. , 2015, Publisher- John Wiley & Sons, ISBN: 9781118867525.

Continuous Internal Evaluation (CIE): Theory (100 Marks)

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Total CIE is 20(Q)+50(T)+30(EL)=100 Marks

Semester End Examination (SEE): Theory (100 Marks)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	L	M	-	L	M	L	-	-	M	-	-
CO2	L	L	-	H	H	L	-	-	-	M	-	-
CO3	-	M	M	H	M	H	H	-	-	M	-	-
CO4	L	L	H	H	H	M	L	-	-	M	-	-

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

CO/PSO	PSO1	PSO2
CO1	M	H
CO2	M	M
CO3	L	H
CO4	L	M

High-3: Medium-2: Low-1

SEMESTER: V			
SOFTWARE PERFORMANCE ENGINEERING			
(Theory)			
Course Code	:	18MCA532	CIE Marks : 100
Credits: L:T:P	:	3:0:0	SEE Marks : 100
Total Hours	:	39L	SEE Duration : 3 Hrs
Unit – I			08Hrs
Basics of Performance Engineering –Role of performance requirements in Performance Engineering, Examples, Business and process aspects of performance Engineering, Disciplines and techniques used in performance engineering, Roles and activities of a performance Engineer Interactions and performance between performance Engineering and other activities			
Unit – II			08Hrs
Performance Requirements -Qualitative attributes related to system performance, Concept of sustainable load, formulation of Response time and throughput requirements, Derived and implicit performance requirements, Elicitation and management of performance requirements			
Unit – III			08Hrs
Performance metrics and analysis -Examples of performance metrics, useful properties of performance metrics, Explicit and implicit metrics, Performance metrics in different domains; Characterizing the performance of a queue, Basic performance laws, Open and closed Queuing network models, Bottleneck analysis			
Unit – IV			08Hrs
System measurement techniques and instrumentation -Distinguishing between measurements and testing, resource usage measurements, utilizations and averaging time window, Measurement of multi-core and multi-processor system, Measurement in production versus Performance testing and scalability, Interpreting measurements in Virtualized environments			
Unit – V			07Hrs
Performance Testing –overview, special challenges, Performance test planning and performance models, A wrong way to evaluate system achievable system throughput, provocative performance testing, preparing a performance test, Lab discipline, Challenges, Scripts and checklists, Best practices, Automating performance tests and the analysis of the outputs			
Case Study: To explore the Performance testing using tools like JMeter, Locust, The Grinder.			

Course Outcomes: After going through this course the students will be able to	
CO1:	Demonstrate the fundamentals of software Performance Engineering in real world scenarios
CO2:	Identify various performance requirements and apply relevant methods/models
CO3:	Investigate different levels of Performance analysis
CO4:	Implement performance metrics in various domains

Reference Books	
1	“Foundations of Software and System Performance Engineering”, Andre B. Bondi, 1 st Edition, 2015, Pearson, ISBN-13:9780321833822
2	“Performance Solutions: A Practical Guide to Creating Responsive, Scalable Software” , Connie Smith and Lloyd Williams, 1 st Edition, Addison Wesley, ISBN-13: 978-0201722291
3	“Performance by Design: Computer Capacity Planning By Example”, Daniel A. Menasce, Dowdy, Almeida, 1st Edition, Pearson, ISBN-13: 978-0130906731
4	“Non-Functional Requirements in Software Engineering”, L.Chung, B. Nixon, E. Yu and J. Mylopoulos, 2009, Springer, ISBN 978-1-4615-5269-7

Continuous Internal Evaluation (CIE): Theory (100 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Experiential Learning(EL). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two Experiential Learnings are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(EL)=100 Marks

Semester End Examination (SEE): Theory (100 Marks)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	L	M	L	-	-	M	M	M	-	-
CO2	M	H	L	H	M	-	M	H	M	H	M	L
CO3	M	M	-	-	M	M	-	M	-	M	M	-
CO4	L	H	-	M	M	-	M	H	M	M	L	L

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

CO/PSO	PSO1	PSO2
CO1	M	L
CO2	H	M
CO3	M	M
CO4	M	H

High-3: Medium-2: Low-1

SEMESTER: V			
PRINCIPLES OF UI / UX DESIGN (Theory)			
Course Code	: 18MCA533		CIE Marks : 100
Credits: L:T:P	: 3:0:0		SEE Marks : 100
Total Hours	: 39L		SEE Duration : 3 Hrs
Unit – I			07 Hrs
Introduction to User Interface Design Process			
Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Guideline, principles, and theories, Managing Design Processes: Organizational Design to support Usability, The Four Pillars of Design, Development methodologies, Ethnographic Observation			
Unit – II			08 Hrs
Evaluating Interface Design and Interacting Styles			
Evaluating Interface Design: Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments; Virtual Environments: Introduction to 3D Interfaces; Menu Selection, Form Filling and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays			
Unit – III			08Hrs
Quality of Service and Information Search			
Quality of Service: Introduction, Models of Response-Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response time, Balancing Function and Fashion: Introduction, Error Messages, Non-anthropomorphic Design, Display design, Window Design, Colour. Information Search: Introduction, Search in Textual Documents and Database Querying, Multimedia document searches			
Unit – IV			08Hrs
User Experience Design			
Introduction to User Experience, From product design to user experience design, Designing for experience, User experience and the web, Building from bottom to top, Elements of user experience; Strategy Plane : Product Objectives, Business goals, Brand Identity ,Success Metrics and User Needs, User Segmentation, Usability and User Research, Creating Personas			
Unit – V			08Hrs
Structure Plane and Surface Plane			
Structure Plane: Defining the Structure Interaction Design, Conceptual Models, Error Handling, Information Architecture, Structuring Content, Architectural Approaches ,Organizing Principles; Surface Plane: Sensory Design, Defining the Surface, Making Sense of the Senses, Contrast and Uniformity, Internal and External Consistency, Colour Palettes and Typography, Design Comps and Style Guides			

Course Outcomes: After going through this course the students will be able to	
CO1:	Understand the theoretical foundations and awareness of user interface and user experience design
CO2:	Apply various design skills in UI and UX for real world applications
CO3:	Demonstrate Quality of Service in design strategies, approaches and technical documentation Process
CO4:	Evaluate UI/UX design process, artefacts for building products

Reference Books	
1	“Designing the User Interface”, Ben Shneiderman, Plaisant, Cohen, Jacobs, 5th Edition, 2014, Pearson Education, ISBN-10: 9332518734 ISBN-13: 978-9332518735
2	“The Elements of User Experience: User-Centred Design for the Web”, Jesse James, ,2 nd Edition, 2011 New Riders Publishers, ISBN-10: 0321683684 ISBN-13: 978-0321683687
3	“Sketching User Experiences: Getting the Design Right and the Right Design” , Morgan Kaufmann, 2007, ISBN-10: 0123740371 ISBN-13: 978-0123740373
4	“Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests”, Jeffrey Rubin, Dana Chisnell, 2 nd Edition,2008 Wiley India Private Limited, ISBN-10: 8126516909 ISBN-13: 978-8126516902

Continuous Internal Evaluation (CIE): Theory (100 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Experiential Learning(EL). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two Experiential Learnings are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(EL)=100 Marks

Semester End Examination (SEE): Theory (100 Marks)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

CO/PO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	L	M	M	-	L	-	L	L	L	-
CO2	M	M	M	L	L	L	M	-	M	L	M	L
CO3	M	L	M	L	L	-	L	-	M	-	M	-
CO4	M	M	M	M	M	L	M	-	M	-	M	L

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

CO/PSO	PSO1	PSO2
CO1	M	H
CO2	M	H
CO3	L	M
CO4	M	M

High-3: Medium-2: Low-1

SEMESTER: V			
CLOUD COMPUTING (Theory & Practice)			
Course Code	:	18MCA541	CIE Marks : 100+50
Credits: L:T:P	:	3:1:1	SEE Marks : 100 +50
Total Hours	:	39L+26T+26P	SEE Duration : 3 Hrs(T) 3 Hrs(P)
Unit – I			07 Hrs
Introduction & Concepts: Introduction to Cloud Computing: Introduction, Characteristics of Cloud Computing, Cloud Models, Cloud Service Examples, Cloud-based Services & Applications.			
Unit – II			08Hrs
Cloud Concepts & Technologies: Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring, Software Defined Networking, Network Function Virtualization, Identity and Access Management, Service Level Agreements, Billing. Parallel and Distributed Systems: Parallel Computing, Distributed Systems.			
Unit – III			08Hrs
Cloud Application Design: Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.			
Unit – IV			08Hrs
Cloud Security: Introduction, CSA (Cloud Security Architecture) Authentication, Authorization, Identity & Access Management, Data Security, Key Management, Auditing. Virtual Machine Security, Security of Virtualization, Security risk posted by a management OS.			
Unit – V			08 Hrs
Multimedia Cloud: Introduction, case study- live video streaming app, streaming protocols Cloud Application Benchmarking & Tuning: Introduction, workload characteristic, application performance matrices, design consideration for a bench marking methodology, benchmarking tools, deployment prototyping, load testing and bottle neck detection case study.			
Unit – VI(Lab Component)			
Note: Students should create an Account from any Public Cloud by Cloud Service Providers to run the following Programs.			
<ol style="list-style-type: none"> 1. Launch a Linux or Window Server by creating VPC, Route Table in a cloud. 2. Create Storage space using S3 Services in cloud. 3. Demonstrate Load Balancer and Elastic IPs concept in cloud. 4. Create a new user from root using Identity and access management (IAM). 5. Create RDS Server and connect using MySQL Workbench. 6. Run the PHP Code on EC2 instance that retrieve data from RDS Server. 7. Building own static website and hosting application from desktop. 8. Demonstrate ECLIPSE Integration with cloud. 9. Run JAVA application by connecting to RDS Server in cloud. 10. Demonstrate auto scaling group concept in cloud. 			

Course Outcomes: After going through this course the students will be able to	
CO1:	Understand the fundamental concepts of cloud computing environment
CO2:	Identify the various key enabling technologies for cloud computing
CO3:	Apply multiple cloud application to the various programming models
CO4:	Compare the different cloud platforms to the cloud computing scenarios

Reference Books:	
1.	“Cloud Computing A Hands-on Approach”, ArshdeepBahga, Vijay Madiseti, , 2014 , Edition University Press ISBN: 9788173719233
2.	“ Cloud Computing Theory And Practice” , Dan C. Marinescu, 2016, Morgan Kaufmann Publication, ISBN: 978-93-5107-094-8
3.	“Cloud Computing Principles and paradigms”, RajkumarBuyya , James Broberg , Andrzej Goscinski, 2011, WILEY Publications , ISBN 978-0-470-88799-8
4.	“Cloud Computing Bible”, Barrie. Sosinsky , 2011, WILEY Publishing, Inc. , ISBN: 978-0-470-90356-8

<p>Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)</p> <p>CIE is executed by way of Quizzes(Q), Test(T) and Experiential Learning(EL). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two Experiential Learnings are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project</p> <p>Total CIE is 20(Q)+50(T)+30(EL)=100 Marks</p> <p>Continues Internal Evaluation (CIE): Practical (50 Marks)</p> <p>The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50</p> <p>Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)</p> <p>The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.</p> <p>Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks</p>
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Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	--	L	--	--	M	--	M	M	L	M
CO2	L	M	M	--	--	--	H	L	--	L	--	M
CO3	M	L	--	M	--	--	L	M	M	--	L	L
CO4	M	H	L	--	--	--	M	L	L	L	M	--
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
CO/PSO	PSO1						PSO2					
CO1	H						M					
CO2	M						-					
CO3	L						H					
CO4	-						L					
High-3: Medium-2: Low-1												

SEMESTER: V			
INTERNET OF THINGS (Theory & Practice)			
Course Code	:	18MCA542	CIE Marks : 100+50
Credits: L:T:P	:	3:1:1	SEE Marks : 100+50
Total Hours	:	39L+26T+26P	SEE Duration : 3 Hrs(T) 3 Hrs(P)
Unit – I			07 Hrs
Introduction to Internet of Things: Fundamentals of Electronics and devices for Internet of Things. Physical and Logical design of IoT Technologies that enable Internet of Things Applications and Use cases, IoT Deployment Levels. Network and Communication, Standards related to Internet of Things, Protocols in Internet of things			
Unit – II			08Hrs
Programming with Arduino : Understanding the eco system of arduino, Pinout configuration, Digital input and output, Analog input and output, working with sensors and actuators. Arduino serial communication. Communication interfaces (SPI and I2C) wired and wireless communication with arduino and logging sensor data from arduino.			
Unit – III			08Hrs
Programming with Raspberry Pi : Understanding the eco system of Raspberry Pi3, Pinout configuration, Digital input and output, working with sensors and actuators. Raspberry Pi serial communication. Communication interfaces (SPI and I2C) wired and wireless communication with raspberry Pi. Serial communication from raspberry Pi3 to Arduino			
Unit – IV			08Hrs
Programming with esp8266 (node mcu) and esp32: Understanding the eco system of esp8266and esp 32, pinout configuration, Digital, Analog input and output, working with sensors and actuators. Communication from raspberry Pi to nodeMCU/esp32, Network configuration with esp8266 and esp32 , wireless communication using nodeMCU and esp32			
Unit – V			08 Hrs
IoT Application Development, Integrating sensors with IoT Dashboards and notification services NodeJS / Django Based web application development to monitor and control IoT devices. Integration of Adafruit / Thingsboard and similar tools with sensors and actuators. Integrating Applications with notification services Introduction to Flow based IoT Dashboard : NodeRED Introduction to MQTT based Dashboard implementation : Open HAB Introduction to IoT data visualization tools and technologies : visualization libraries and dashboard			

Lab Component

Implement the following programs using

1. Write a program with Arduino UNO board to calculate the distance of a obstacle based on the Ultrasonic sensor inputs. If the distance calculated is less than a certain value turn on a buzzer / beeper with a LED in ON state and display the distance in LCD / OLED
2. Write a program with Arduino UNO to indicate the level of temperature using the LEDs indicating the low, medium and high values of temperature (Red, Blue and Green) **OR** Write a program with Arduino UNO to implement the interactive traffic signal.
3. Write a interactive python script on Raspberry Pi3 to implement the serial communication from Raspberry Pi to Arduino and vice versa with the following components
a) LED b) Buzzer c) Temperature and humidity sensor d) four channel relay
4. Write a python script on Raspberry pi to control servo motor or DC Motor based on the potentiometer meter or button switch inputs. **OR** change the color of RGB LED / Bulb based on the potentiometer
5. Write a micro python script /arduino sketch with esp8266/esp32 based board to calculate the distance of a obstacle based on the Ultrasonic sensor inputs. If the distance calculated is less than a certain value turn on a buzzer / beeper with a LED in ON state and display the distance in LCD / OLED
6. Write a micro python script/arduino sketch with esp8266 / esp32 board to operate a 4 channel relay demonstrating minimal home automation and integrate with a dashboard
7. Integrate Blink / ThingsBoard /openhab to any of the experiments done above or any sensor and actuator used in the experiments above
8. Develop a django dashboard to monitor and control the sensor and actuators **OR** Develop a program to tweet about a sensor value and the status of a actuator.
9. Develop a Dashboard using NodeRED to monitor ,control any two sensor , actuators
10. Develop a python program on raspberry pi to get the sensor value from Raspberry pi to another using network programming **OR** Develop a python program to send email to a particular email the temperature / humidity read from DHT11 sensor when a button is pressed.

Course Outcomes: After going through this course the students will be able to

CO1:	Understand the fundamentals of electronics and devices needed for IoT including deployment levels, Network protocols and standards.
CO2:	Differentiate between various development boards, sensors, actuators, architecture of Arduino, Raspberry Pi, nodemcu and esp32 with Arduino IDE and other frameworks
CO3:	Interact with Arduino, RaspberryPi, nodemcu and esp32 using python, JavaScript and C/C++ to program the devices (sensors and actuators)
CO4:	Develop minimal IoT Applications and integrate several essential services

Reference Books:	
1.	“Exploring Arduino: Tools and Techniques for Engineering”, Wizardry, 1st Edition WILEY, ISBN-10: 1118549368, ISBN-13: 978-1118549360
2.	“Internet of Things with Raspberry Pi 3”, Maneesh Rao, PackPublihing,
3.	“Internet of Things with ESP8266”, Marco Schwartz , 29 Jul 2016, PACKT
4.	Internet of Things: A Hands-on Approach by ArshdeepBahga, Vijay Madiseti, July 1st 2015 by Orient Blackswan Private Ltd ISBN : 8173719543
5.	“Building the Web of Things” , Dominique D. Guinard and Vlad M. Trifa, Manning Publication, ISBN 9781617292682
6.	The Official ESP32 Book , ISBN : 978-1-907920-63-9, Elector

Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks)

CIE is executed by way of Quizzes(Q), Test(T) and Experiential Learning(EL). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two Experiential Learnings are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project

Total CIE is 20(Q)+50(T)+30(EL)=100 Marks

Continues Internal Evaluation (CIE): Practical (50 Marks)

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	--	L	L	--	M	--	M	M	L	--
CO2	L	M	M	--	L	--	H	L	--	L	--	--
CO3	M	M	M	M	M	--	M	--	--	--	--	--
CO4	M	H	H	M	H	L	M	L	L	L	M	M

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

CO/PSO	PSO1	PSO2
CO1	L	L
CO2	M	M
CO3	M	H
CO4	H	H

High-3: Medium-2: Low-1

SEMESTER: V					
VIRTUAL REALITY (Theory & Practice)					
Course Code	:	18MCA543	CIE Marks	:	100+50
Credits: L:T:P	:	3:1:1	SEE Marks	:	100+50
Total Hours	:	36L+26T+26P	SEE Duration	:	3 Hrs(T) 3 Hrs(P)
Unit – I				09 Hrs	
Introduction: Virtual Reality, Virtual Reality Applications					
Birds-eye view : Hardware, Software, Human Physiology and perception					
Objects and Scale: Getting started with Unity- Starting a new Unity project, The Unity editor, The default world space. Adding a cube, plane etc. An introduction to Blender. Importing from Blender to Unity.					
Unit – II				08 Hrs	
Introduction : Augmented Reality, Mixed Reality, its applications, Creating a Image marker, AR Database, Integrating in Unity,					
Geometry of Virtual Worlds: Geometric models, Transforming models, 2D and 3D rotation yaw, pitch, and roll. Viewing Transformations, Chaining the Transformations					
Unit – III				07 Hrs	
Tracking: Tracking 2D and 3D orientation.					
Physics and the Environment: Unity physics, Bouncy balls					
Unit – IV				07 Hrs	
Visual Rendering: Visual Rendering overview, Ray Tracing and Shading Models, Rasterization, VR-specific problems.					
Gaze-based Control: Ethan, the walker- Artificially intelligent Ethan, The Navmesh bakery, The Random Position script for Ethan, Ray casting.					
Unit – V				05 Hrs	
First-person Character: Understanding the Unity characters - The Camera component, The Rigid body component, The Character Controller component. Unity Standard Assets- Third Person Controller, AI Third Person Controller, First Person Controller, Rigid Body FPS Controller. Making a first person, User calibrations, Managing VR motion sickness					
Unit – VI(Lab Component)					
<ol style="list-style-type: none"> 1. Create a 3D object and Apply different geometric Transformations using Mouse/Keyboard 2. Bouncing ball on multiple 2D/3D platforms 3. Develop First Person Controller to a Scene 4. Create a 3D Character movement 5. Making a basic AR app 6. Create a menu driven interface for adding and removing objects from a Scene 7. Finding target using 2D Ray-caster 8. Create a marker based app that places a jumping and dancing model on a plane by real-time detection. 9. Create and show motion effect using time scale and scripts for 2D images. 10. Design and Develop a VR Game 					

Course Outcomes: After going through this course the students will be able to	
CO1:	Understand the concepts of Virtual Reality and its Applications
CO2:	Discuss the Principles of Virtual Reality
CO3:	Demonstrate a virtual environment to captivate its experiences
CO4:	Analyse the fundamental issues of virtual reality

Reference Books:	
1	“Learning Virtual Reality, Developing Immersive Experiences and Applications for Desktop, Web and Mobile”, Tony Parisi, first edition, 2015, O’Reilly Media, Inc., ISBN-13: 978-93-5213-257-7
2	“Unity Virtual Reality Projects”, Jonathan Linowes, first edition, 2015, Packt Publishing Ltd., ISBN 978-1-78398-855-6
3	“Virtual Reality”, Steven M. LaValle, Copyright Steven M. LaValle 2017 Available for downloading at http://vr.cs.uiuc.edu/
4	“Augmented Reality Principles and Practice”, Dieter Schmalstieg and Tobias Höllerer, Addison-Wesley, 2016, ISBN-13: 978-0-321-88357-5

<p>Continuous Internal Evaluation (CIE): Theory (100 Marks) + Practical (50 Marks) CIE is executed by way of Quizzes(Q), Test(T) and Experiential Learning(EL). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two Experiential Learnings are given with a combination of two component among 1) solving innovative problem 2) seminar/new developments in the related course 3) Laboratory work 4) Minor project Total CIE is 20(Q)+50(T)+30(EL)=100 Marks</p> <p>Continues Internal Evaluation (CIE): Practical (50 Marks) The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 50 marks and reduced to 10 marks. Total marks for the laboratory is 50</p> <p>Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit. Practical: SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks</p>
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Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	L	L	M	L	-	-	-	-	-	-
CO2	H	M	M	L	M	-	-	-	L	-	L	-
CO3	-	-	H	L	H	-	-	M	M	-	L	-
CO4	-	L	L	H	L	-	-	-	L	-	-	-
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
CO/PSO	PSO1						PSO2					
CO1	L						L					
CO2	L						L					
CO3	H						H					
CO4	M						H					
High-3: Medium-2: Low-1												

SEMESTER: V				
SEMINAR - I				
Course Code	:	18MCA55	CIE Marks	: 50
Credits: L:T:P	:	0:0:2	SEE Marks	: 50
Hrs/Week	:	2	SEE Duration	3 Hrs
GUIDELINES				
<ol style="list-style-type: none"> 1. The seminar presentation shall be done by individual students. 2. The topic for seminar should be in one of the thrust areas relevant to industry or on-going research with in-depth technical review and analysis. 3. The student must be able to highlight or relate the technological developments with societal relevance and sustainability. 4. The students must mandatorily address professional computing practices relevant to the topic of study. 5. The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study. 6. Each student must submit both hard and soft copy of the presentation and report. 				

Course Outcomes: After going through this course the students will be able to	
CO1:	Identify topics in cutting edge areas in computing technology relevant to sustainability and societal concern
CO2:	Conduct literature / market / product survey and analyse information in the field of study
CO3:	Enhance communication skills and report writing skills
CO4:	Exhibit creative thinking abilities

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of guide and senior faculty members. The evaluation criteria shall be as per the rubrics given below:

The evaluation criteria shall be as per the rubrics given below:

Reviews	Activity	Weightage
Phase 1	Selection of topic – Technical Relevance, review of literature, Presentation skills, Sustainability and Societal Concerns	50%
Phase 2	Technological developments, key competitors, Presentation skills, Report writing	50%

Scheme for Semester End Evaluation (SEE)

The evaluation will be done by ONE Senior faculty / Internal Guide from the department and ONE External member from Academia / Industry / Research Organization. Evaluation will be done in batches 6 students per batch and maximum of 03 batches per day per examiner.

Rubrics for SEE evaluation

- Topic 10%
- Literature Review 20%
- Technical relevance, Sustainability and Societal Concerns 30%
- Presentation Skills 20%
- Viva- Voce 20%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	M	M	M	M	H	H	-	-	L	M	-
CO2	L	M	-	-	-	-	-	-	-	H	-	-
CO3	-	L	M	-	H	L	L	-	-	-	M	-
CO4	-	-	-	-	-	L	L	M	H	-	-	-
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
CO/PSO	PSO1						PSO2					
CO1	M						L					
CO2	L						L					
CO3	L						L					
CO4	L						L					
High-3: Medium-2: Low-1												

MINOR PROJECT – II					
Course Code	:	18MCA56	CIE Marks	:	100
Credits :L:T:P	:	0:0:4	SEE Marks	:	100
Hrs/Week	:	04	SEE Duration	:	03 Hrs
GUIDELINES					
1. Each project group will consist of maximum of two students The Student shall undertake minor project- II depending on the electives studied in the previous semesters / Research based / Industry Oriented Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey 2. Allocation of the guides preferably in accordance with the expertise of the faculty 3. The number of projects that a faculty can guide would be limited to six 4. The minor project would be performed in-house 5. The implementation of the project must be preferably carried out using the resources available in the department/college					

Course Outcomes: After going through this course the students will be able to	
CO1:	Conceptualize, design and implement solutions for specific problems
CO2:	Communicate the solutions through presentations and technical reports
CO3:	Apply resource managements skills for projects
CO4:	Synthesize self-learning, team work and ethics

Scheme of Continuous Internal Examination (CIE)

Evaluation of the project work will be done by the committee appointed by the director, Dept. of MCA. The student should submit report on the mini project work. Evaluation will be carried out in THREE Phases.

Phase	Activity	Weightage
I	Synopsis submission, Preliminary seminar for the approval of selected topic and objectives formulation, Literature survey	20%
II	Midterm seminar to review the progress of the work Design and Simulation/Algorithm development / Experimental Setup	40%
III	Conducting experiments / Implementation / Testing - Oral presentation, demonstration and submission of project report	40%

Scheme for Semester End Examination (SEE)

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

Rubrics for SEE evaluation

- Project work 40%
- Presentation 30%
- Viva-voce 30%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	H	H	-	-	M	-	H	H	
CO2	-	-	-	-	H	-	-	H	H	H	-	
CO3	H	H	M	-	M	M	H	H	-	M	H	
CO4	-	H	-	-	-	H	M	M	M	H	-	
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
CO/PSO	PSO1						PSO2					
CO1	H						M					
CO2	-						L					
CO3	-						M					
CO4	M						M					
High-3: Medium-2: Low-1												

SEMESTER: VI					
MAJOR PROJECT					
Course Code	:	18MCA61	CIE Marks	:	100
Credits L:T:P	:	0:0:20	SEE Marks	:	100
Hrs/Week	:	40	SEE Duration	:	03 Hrs
Course Learning Objectives:					
The students shall be able to					
1. Understand the method of applying technical knowledge to solve specific problems.					
2. Apply software engineering and management principles while executing the project					
3. Demonstrate good verbal presentation and technical report writing skills					
4. Identify and solve complex application / research oriented problems using professionally prescribed standards					
GUIDELINES					
1. Major project will have to be done by only one student in his / her area of interest					
2. Each student has to select a contemporary topic in the area of application or research that will use the technical knowledge and skill set					
3. The project can be carried out on-campus or in an industry or an organization with prior approval from the Director, Department of MCA					
4. Students carrying out the Project In house are required to be present in the college every day and report to the Internal Guide					
5. The candidate must maintain and submit weekly project work dairy duly signed by the internal and external guide to verify the regularity of the student					
6. Internal Evaluation of the project work will be done by the evaluation committee appointed by the Director, Department of MCA.					
7. The standard duration of the project is for 5 month duration, however if the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the committee.					
8. Students are mandatorily required to publish in reputed journals/ conferences.					

Course Outcomes: After going through this course the students will be able to	
CO1:	Conceptualize, design and implement solutions for specific problem defined
CO2:	Communicate the solutions through presentations and dissertation report
CO3:	Apply project and resource management skills, professional ethics and societal concerns
CO4:	Exhibit self-learning, lifelong learning skills towards sustainable solutions

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide and members appointed by Director, MCA

Phase	Activity	Weightage
I	Synopsis submission, Preliminary seminar for the approval of selected topic , review and refinement of objectives, Literature survey	20%
II	Mid-term seminars to review the progress of the work and documentation – SRS and algorithm development, Design and simulation/ experimental set up	40%
III	Experimental result & analysis, testing, Conclusions and Future Scope of Work, Dissertation Report	40%

Note -

- 50% CIE is the pre requisite to appear for SEE
- Two hard bound dissertation reports are to be submitted. The report has to be in light yellow color
- Certificate sheet having the signatures of Guide, Director and Principal must be included
- Plagiarism report must be <20% and to be included in the report
- Technical paper publication in reputed Journals/ National / International Conference is mandatory**

Scheme for Semester End Examination (SEE):

The evaluation will be done by ONE Senior faculty / Internal Guide from the department and ONE External member from Academia / Industry / Research Organization. Evaluation will be done in batches not exceeding SIX students per batch and maximum of 12 students per day per examiner.

SEE procedure is as follows

	Internal Examiner	External Examiner	Total	
SEE Dissertation	100 marks	100 marks	200 marks	
			(A)	(200/2) = 100 marks
Viva Voce	Jointly Evaluated by Internal and External Examiner		(B)	100 marks
		Total Marks	[(A)+(B)]/2 = 100	

Final Marks / Grades = (CIE+SEE)/2

Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	L	M	L	-	-	-	L	L
CO2	-	-	-	-		M	-	M	H	-	-	-
CO3	-	-	-	-	L	M	M		-	H	L	-
CO4	-	-	-	-	L	M	H	M	-	-	H	L
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
	PSO1						PSO2					
CO1	H						H					
CO2	L						L					
CO3	M						L					
CO4	H						H					
High-3: Medium-2: Low-1												

SEMESTER: VI					
SEMINAR-II					
Course Code	:	18MCA62	CIE Marks	:	50
Credits: L:T:P	:	0:0:2	SEE Marks	:	50
Hrs/Week	:	2	SEE Duration	:	--
GUIDELINES					
<ol style="list-style-type: none"> The seminar presentation shall be done by individual students. The topic for seminar should be in one of the thrust areas relevant to industry or on-going research with in-depth technical review and analysis The topic can also be an extension of the Major project The student must be able to highlight or relate the technological developments with societal relevance and sustainability The students must mandatorily address professional computing practices relevant to the topic of study The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study Each student must submit both hard and soft copy of the presentation and report 					

Course Outcomes: After going through this course the students will be able to	
CO1:	Identify topics in recent trends in computing technology.
CO2:	Perform literature / market / product survey and analyse information in the field of study
CO3:	Enhance communication skills and report writing skills
CO4:	Exhibit creative thinking abilities

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of guide and senior faculty members. The evaluation criteria shall be as per the rubrics given below:

The evaluation criteria shall be as per the rubrics given below:

Reviews	Activity	Weightage
Phase 1	Selection of topic – Technical Relevance, review of literature, Presentation skills, Sustainability and Societal Concerns	50%
Phase 2	Technological developments, key competitors, Presentation skills, Report writing	50%

Scheme for Semester End Evaluation (SEE)

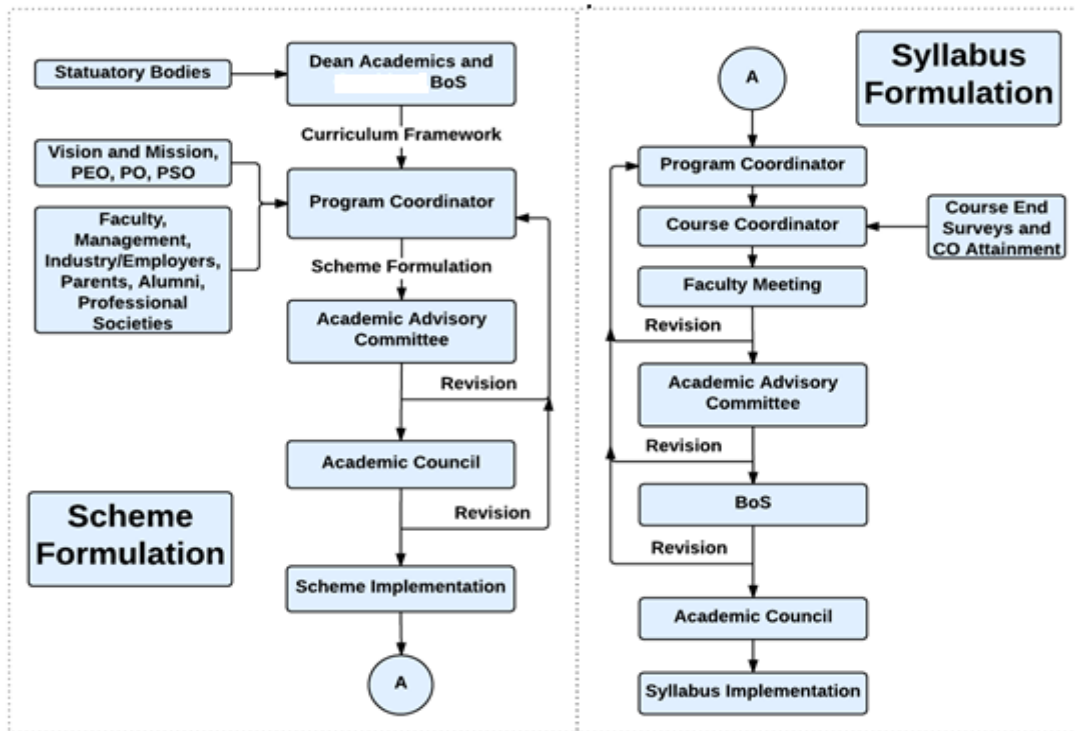
The evaluation will be done by ONE Senior faculty / Internal Guide from the department and ONE External member from Academia / Industry / Research Organization. Evaluation will be done in batches 6 students per batch and maximum of 03 batches per day per examiner.

Rubrics for SEE evaluation

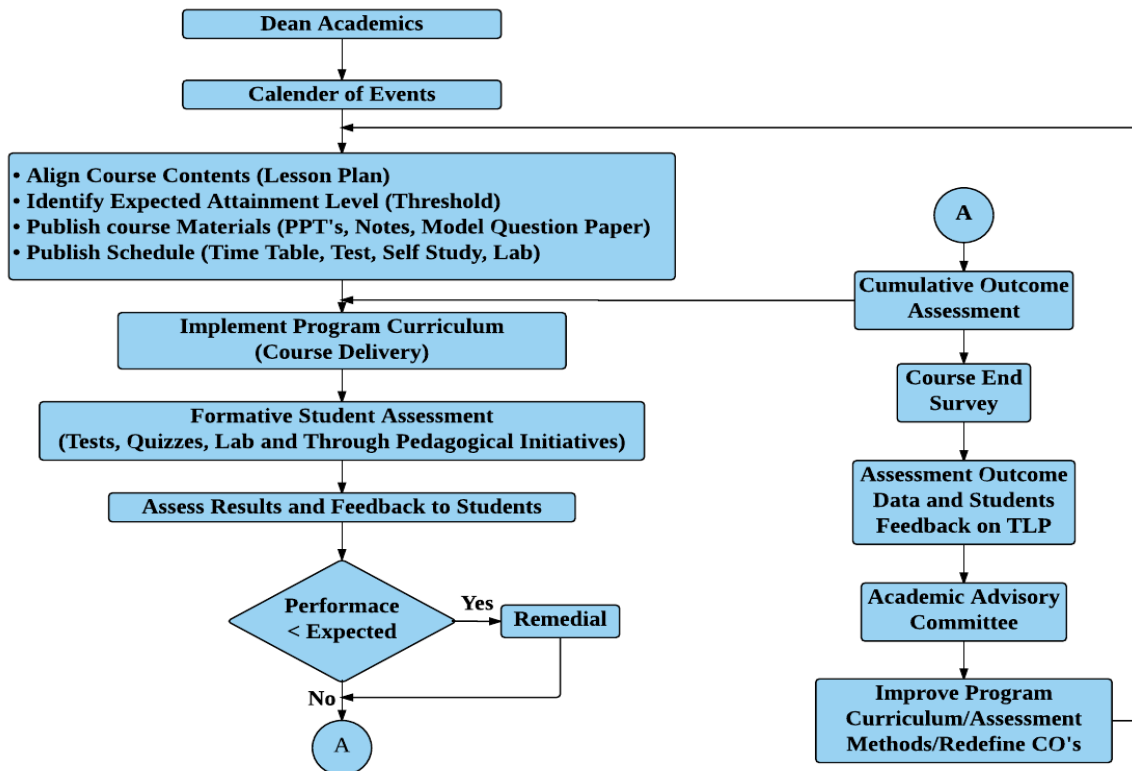
- Topic 10%
- Literature Review 20%
- Technical relevance, Sustainability and Societal Concerns 30%
- Presentation Skills 20%
- Viva- Voce 20%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	M	M	M	M	H	H	-	-	L	M	-
CO2	L	M	-	-	-	-	-	-	-	H	-	-
CO3	-	L	M	-	H	L	L	-	-	-	M	-
CO4	-	-	-	-	-	L	L	M	H	-	-	-
Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)												
	PSO1					PSO2						
CO1	M					L						
CO2	L					L						
CO3	L					L						
CO4	L					L						
High-3: Medium-2: Low-1												

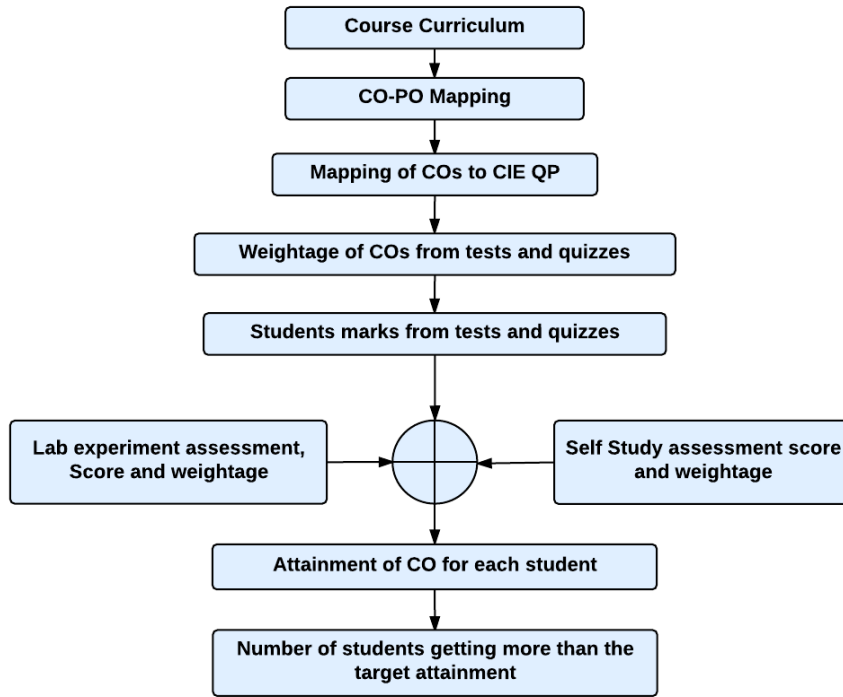
Curriculum Design Process



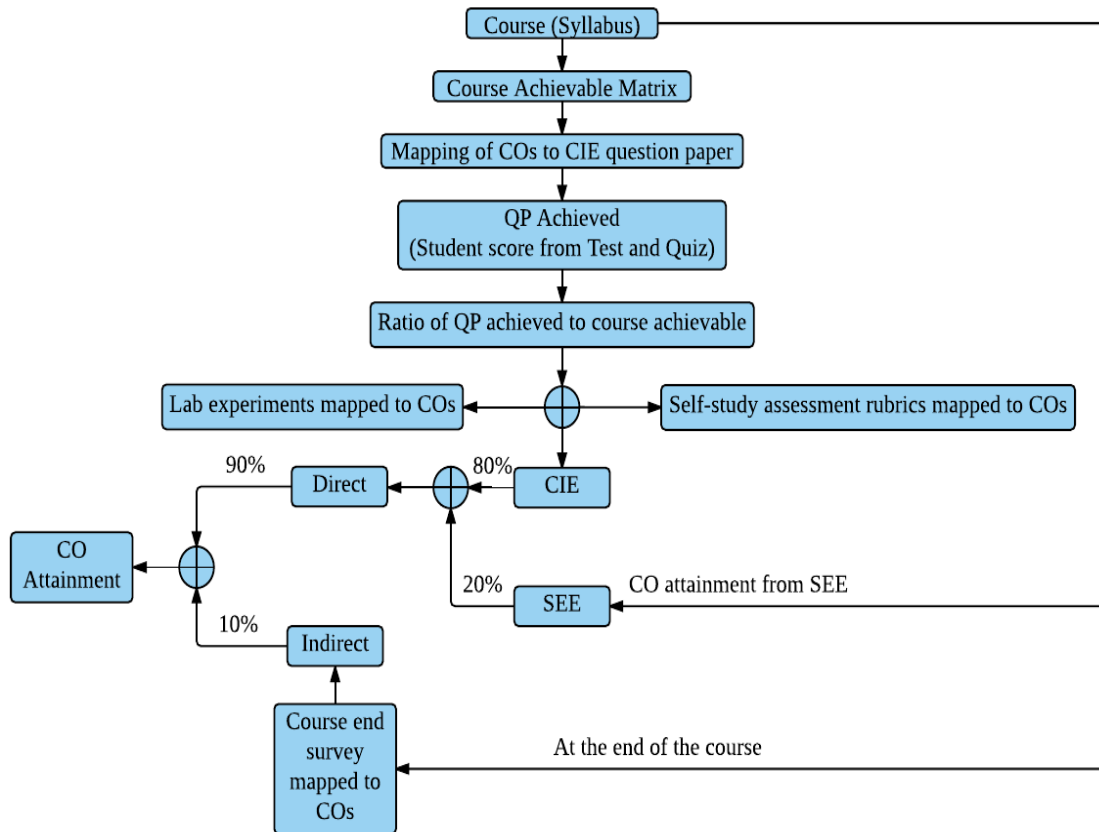
Academic Planning and Implementation



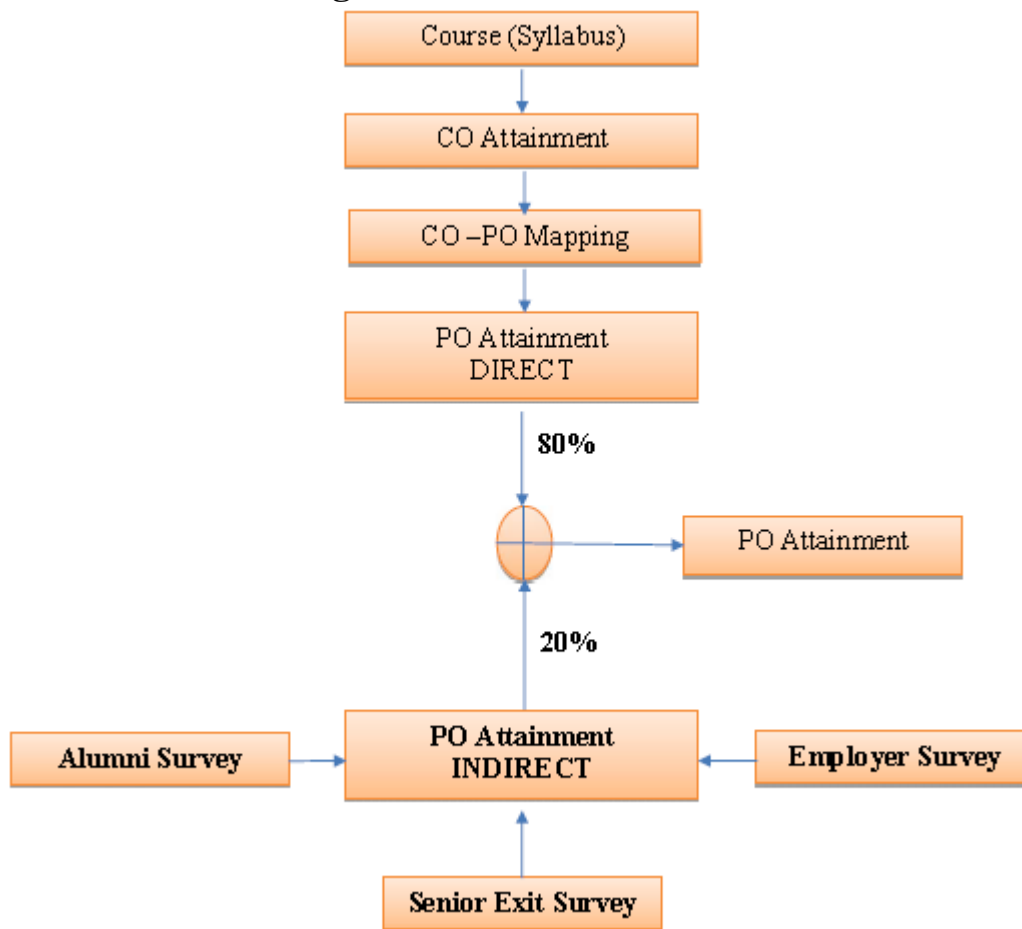
Process for Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



PROGRAMME OUTCOMES (PO)

MCA graduates will be able to:

- PO1 Computational Knowledge:** Acquire in-depth computational knowledge and mathematics with an ability to abstract and conceptualize models from defined problems and requirements
- PO2 Problem Analysis:** Identify, formulate, conduct literature survey and solve complex computing problems through analysis as well as provide optimal solutions
- PO3 Design / Development of Solutions:** Design and evaluate solutions for complex problems, components or processes that meet specified needs after considering public health and safety, cultural, societal, and environmental factors
- PO4 Conduct investigations of complex Computing problems:** Conduct literature survey to analyze and extract information relevant to unfamiliar problems and synthesize information to provide valid conclusions and interpret data by applying appropriate research methods, tools and design experiments
- PO5 Use of Modern Tool:** Create, select, adapt and apply appropriate techniques, resources, and modern IT tools to complex computing system activities, with an understanding of the limitations
- PO6 Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices
- PO7 Life-long Learning:** Engage in lifelong learning independently for continual development to improve knowledge and competence as a computing professional
- PO8 Project management and finance:** Demonstrate knowledge and understanding of management principles and apply these to multidisciplinary software development as a team member and manage projects efficiently as a leader considering economical and financial factors
- PO9 Communication Efficacy:** Understand and communicate effectively with the computing community and with society at large, regarding complex computing systems activities confidently and effectively by writing effective reports and design documentations by adhering to appropriate standards, make effective presentations and give / receive clear instructions
- PO10 Societal and Environmental Concern:** Understand responsibilities and consequences based on societal, environmental, health, safety, legal and cultural issues within local and global contexts relevant to professional computing practices
- PO11 Individual and Team Work:** Function effectively as an individual, as a member or leader in diverse teams in multidisciplinary environments
- PO12 Innovation and Entrepreneurship:** Identify a timely opportunity for entrepreneurship and use innovation to pursue and create value addition for the betterment of the individual and society at large